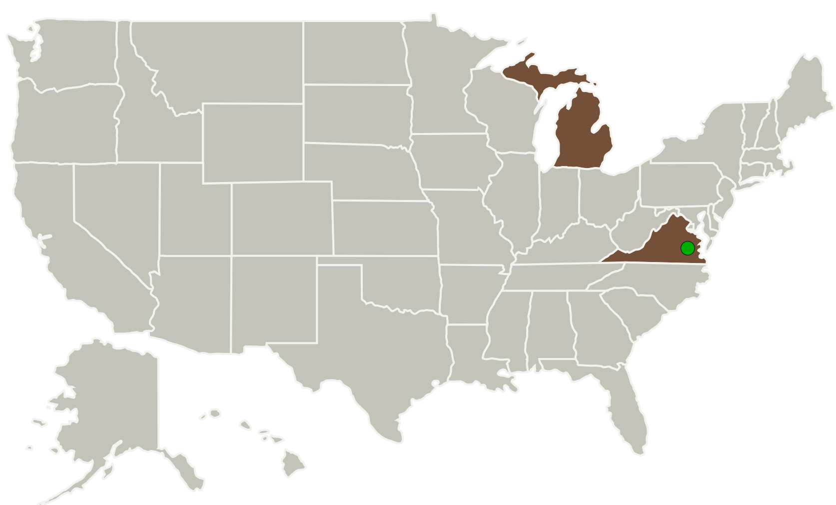
Piezoelectric MEMS Microphones for Ground Testing of Aeronautical Systems, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

Improving the acoustical environment is critical in aeronautics. Airports and aeronautical systems manufacturers are facing ever-increasing demands to reduce noise levels. Aeronautical applications require the use of large arrays of high quality microphones with a large dynamic range. These arrays are expensive. The advent of lower cost microphones that meet the users' specifications would dramatically improve the ability of engineers seeking to quantify the acoustic impact of either their designs or their facilities (e.g., airports) to make data driven decisions to improve any adverse conditions. We seek to develop commercially viable, piezoelectric micro-electro-mechanical systems (MEMS) microphones capable of withstanding the high amplitude sound pressure levels and adverse environmental conditions found in ground testing of the acoustics of aeronautical systems. The acoustical specifications of these microphones (measured by noise floor, linearity, sensitivity) will met or exceed those of existing microphones. Our microphone is a shift from the capacitive sensing scheme that is used in nearly every microphone in use today. Piezoelectric MEMS microphones have significant advantages, over an above their small size (<4 mm x mm). Piezoelectric MEMS microphones require no polarization (unlike capacitive sensors), a significant price advantage when considering implementation in large arrays. In addition, the piezoelectric MEMS microphones can withstand the higher temperatures needed for lead-free re-flow soldering — a significant advantage over electrets (that cannot withstand these high temperatures). This microphone, therefore, holds the promise of superior acoustical performance, lower cost than current technology, ease of implementation into large arrays, and seamless integration into modern microelectronics manufacturing procedures.

Primary U.S. Work Locations and Key Partners



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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Baker-Calling, Inc.	Lead Organization	Industry	Ann Arbor, Michigan
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Michigan	Virginia

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/139957)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Baker-Calling, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

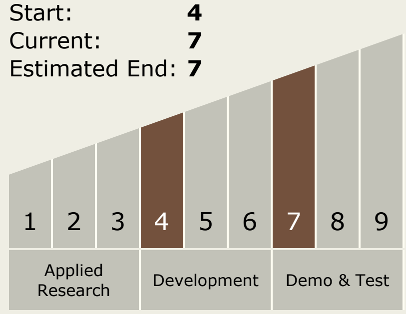
Carlos Torrez

Principal Investigator:

Robert Littrell

Technology Maturity (TRL)

Start: **4**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - └─ TX13.1 Infrastructure Optimization
    - └─ TX13.1.1 Natural and Induced Environment Characterization and Mitigation

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System